Pest Management Grants Final Report

Development of an Integrated Pest Management System for Dry Bean Production

Agreement # 01-0202 C

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Disclaimer

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Executive Summary

Bean planting begins in May with Lima and Blackeye beans and continues through June with Kidney and other common beans. Harvest begins in September and October. The summer growing season requires a pest management program for aphid, spider mite, lygus bugs, leafminer and occasional pod boring caterpillars. Organophosphate insecticide and acaricide applications start at the early bean development stage for aphid and spider mite with dimethoate, dicofol, and propargite. One to three applications of acephate are made to control lygus bug beginning at bud development through the bean filling stage. Leafminer is a pest that occurs mid to late season and a frequent problem when multiple applications of Organophosphates begin early and frequently to control other pests.

In 2001 preliminary research was conducted by Canevari, Brunmeier, Temple to evaluate different planting dates on beans, which could change insect timing, lower pest populations, and reduce the number of insecticide applications. Populations of mites, leafminers and caterpillars were lower for the early planting. In this timing experiment, tests were conducted to evaluate systemic insecticide seed treatments that would provide control to 40 days from bean emergence of early season pests. Systemic control with a reduced-risk product of plant sucking pest such as aphid would eliminate the need of an early foliar application of organophosphate.

In 2002 an expanded trial was conducted to evaluate two planting times, and management programs comparing the current conventional program with an IPM program utilizing new reduced-risk products. The main objectives were to look at the impacts of planting date and insecticide treatment on pest population densities, pest species present, damage to the beans, and yield. The IPM approach utilized thiamethoxam for bean aphid and leafminer, indoxacarb for lygus, bifenazate for two-spotted spider mite, and spinosad for later populations of leafminer. The conventional approach utilized dimethoate for bean aphid, acephate for lygus, propargite for Two-spotted spider mite, and spinosad for leafminer. Planting dates consisted of an early timing in April and a standard timing in June. Mites and leafminers were avoided when planting early. Thiamethoxam, a systemic insecticide seed treatment, provided 100% control of the Bean aphid in the IPM system. The conventional system was planted using untreated seed and had to be treated with dimethoate. Lygus populations were treated with indoxacarb in the IPM System and acephate in the conventional system. Significant differences were seen between treatments with acephate providing better control. When planting at a standard timing, aphids were avoided but leafminers and mites were present in treatable levels. Mites were treated with bifenazate in the IPM system and propargite in the conventional system. Bifenazate provided better control 21 days after treatment compared to propargite. Leafminers were treated with spinosad for both systems since it has become the industry standard and is currently registered as a reduced-risk material in dry beans. Significant differences were seen 12 days after treatment with the IPM system maintaining lower levels of leafminer damage. Lygus populations were treated with indoxacarb for the IPM system and acephate for the conventional system. Differences were seen between treatments with acephate providing better control compared to indoxacarb. No differences in yield were seen between systems but differences were seen between planting dates. Ca. Early Light Red Kidney and Blackeye 46 produced higher yields in the standard planting. Baby Lima yield was unaffected by planting date. Blackeye and Baby Lima were evaluated for lygus damage by taking 500 beans from each treatment and visually examining them for level of damage. The conventional system along with early planting experienced the lowest amount of lygus damage.

Introduction

Objectives:

1.) Investigate a revised production system for dry beans that may have positive impacts on arthropod management that includes the replacement of organophosphate materials with reduced-risk materials.

Task 1: select grower cooperator for study

A grower cooperator was selected in an area with a history of significant arthropod infestations in beans and an area that is appropriate for production of Ca. Early Light Red Kidney , Blackeye 46, and Luna Baby Lima.

Task 2: plan treatment approaches and acquire needed materials

This project compared arthropod management using two different insecticide regimes. A conventional approach utilizing organophosphate and carbamate materials was compared to an IPM system utilizing new reduced-risk products being considered for registration.

Task 3: bean planting for early timing

Beans were planted on April 24, 2003 for the early timing.

Task 4: monitor populations of seedling insect pests

Pest populations were monitored weekly on bean seedlings for the first 4 weeks after emergence.

Task 5: monitor populations of pests on mid-season and reproductive stage beans and treat as necessary for the two different treatment regimes

Populations of spider mites, leafminers, and lygus bugs were monitored. Sweep net samples with a standard 15-inch sweep net was used for lygus bugs. Ten sweep samples were taken weekly, the sample placed in a paper bag, and taken to the lab for counting. In addition, 20 leaves per plot were collected . Leafminer mines, mites, and any other insects present were counted. Reduced-risk and/or conventional treatments were applied as needed using a tractor with a 15'boom.

Task 6: bean planting for standard timing

Beans were planted on June 27,2002 for the standard timing. The procedures, treatments, sampling, etc. will be identical to those described for the early timing (Task 3).

Task 7: data analyses

Each planting date plot was analyzed with a randomized complete block design with factorial treatment structure.

Task 8: reporting data to grower cooperator and appropriate reports

Data will be reported to the grower cooperator and to the bean industry through appropriate outlets.

2.) Compare bean yields and quality characteristics between the IPM production system and the conventional system.

Task 1: harvest plots established under objective 1

Plots were harvested and bean yields determined. Steve Temple harvested plots using the UC Davis trial bean harvester.

Task 2: quantify bean quality/grades
Bean grade were evaluated based on standards determined by the United States Grain and Commodity Inspection Department. Lygus bug damage was the primary target pest for these quality ratings. Varieties evaluated were Blackeye 46 and Luna Baby Lima.
Task 3: estimate economic returns
The economic returns of the IPM production system versus the conventional system was estimated and compared. Inputs from pest management activities versus returns from the bean harvests will be compared. The early-planted system may also reduce irrigation needs and this factor was incorporated.

3.) conduct an additional site in the Southern San Joaquin Valley (Tulare County) to validate the Blackeye information. Tulare County represents the majority of Blackeye acreage and is host to insect timings more relevant to this bean type.
Task 1: Blackeye 46 were planted on May 14, 2002.
Treatment approaches and sampling methods will be identical to the San Joaquin County location.

4.) investigate the utility of thiamethoxam seed treatment as a pest management tool in dry bean production through controlled studies.
Task 1: Establish treatments on greenhouse grown plants
3 rates of thiamethoxam along with an untreated were evaluated.
Task 2: evaluate efficacy of seed treatments on key seedling arthropod pests
Bioassays were conducted on the beans at 2,3,4,and 5 weeks after emergence. Arthropods from laboratory colonies were placed on treated and untreated plants and mortality assessed after 72 hours. Bean aphids, spider mites, and western flower thrips were evaluated in separate tests.
Task 3: evaluate effects of thiamethoxam on minute pirate bugs
Generalist predators feed not only on prey items but they also frequently probe into plant tissue for liquids. This probing activity is the mode through which systemic insecticides can effect predator populations. Greenhouse grown plants treated with thiamethoxam, as described under task 1 were used for this test.
Task 4: data analyses
For each pest species, a factorial analysis will be used with weeks after emergence and treatment as the main effects. For the minute pirate bug test, a factorial analysis will be used with pest status and treatment as the main effects.

Materials and Methods

Plot size was 30' X 60', with 4 replications, in a randomized complete block design. Three varieties of dry beans were planted using a cone planter at a seeding rate of 5 seeds per linear foot. The three bean varieties consisted of California Early Light Red Kidney, Blackeye 46, and Luna Baby Lima. Treatment 1 consisted of an Integrated Pest Management approach utilizing new reduced-risk chemicals. Treatment 2 consisted of a conventional pest management approach utilizing older, standard chemicals currently registered for use.

Objective 1: Two planting dates were evaluated: an early planting on April 24, 2002 and a standard planting on June 27, 2002. Plots were monitored weekly by sampling 20 leaves per plot for each bean variety, management strategy, and planting date. Leaves were inspected and rated for insect damage, species present, and number present. Lygus samples were taken using a standard 15"sweep net with 10 sweeps per plot taken weekly. A factorial analysis was used with bean variety, sampling date, and treatment as the main effects. Means followed by the same letter are not different based on Fisher's protected LSD at $P \leq 0.05$.

Results were presented at the annual Dry bean Field Day on August 30, 2002, the Annual Meeting of the Entomological Society of America on November 18,2002, and at the Annual Dry Bean Workgroup meeting on December 17, 2002. Three more presentations will be given in March. The results of the Baby Lima portion of the trial will be presented to the Baby Lima Council on March 12, 2003. The results from the California Early Light Red Kidney portion of the trial will be presented to the Kidney Council on March 13, 2003. An overview of the complete trial will be presented to the Dry Bean Council on March 19, 2003.

Objective 2: Plots were harvested using the UC Davis research harvester using the two middle beds. Harvest size consisted of 10'(two 5' beds) X 60'. Yields were expressed in pounds per acre. A factorial analysis was used with bean variety and treatment as the main effects; means were separated with Fisher's protected LSD at $P \leq 0.05$. The USDA standards for Blackeyes is: U.S. 1= 4% maximum damage, U.S. 2=6% max. damage, U.S. 3=8% max. damage. The USDA standards for Baby Limas are: U.S. 1=2% max. damage, U.S. 2=4% max. damage, U.S. 3=6% max. damage. Beans that fall below these percentages are considered U.S. substandard. Quality ratings were analyzed using a factorial analysis with bean variety and treatment as the main effects; means were separated with Fisher's protected LSD at $P \leq 0.05$.

Objective 3: The Tulare County location consisted of one standard planting on May 14, 2002 and one bean variety; Blackeye 46. Treatment approaches, insect sampling methods, and harvest were identical to the San Joaquin County location. For lygus a factorial analysis was used with sampling date and treatment as the main effects. For yield a factorial analysis was used with bean variety and treatment as the main effects. Means were separated with Fisher's protected LSD at $P \leq 0.05$.

Objective 4: California Early Light Red Kidneys were planted in 4" pots to conduct this study. Thiamethoxam seed treatments were applied at rates of 1.) 1.7 fl. oz./100 lbs. seed, 2.) 2.8 fl. oz. /100 lbs. seed, 3.) 4.0 fl. oz./100 lbs. seed, and 4.) Untreated. Bioassays were conducted on the beans at 2, 3, 4, and 5 weeks after emergence. Five adult individuals of the bean aphid, western flower thrips, and spider mites were placed on to plants in a clip cage and mortality was assessed after 72 hours. These were conducted as separate tests. A factorial analysis was used with weeks after emergence and treatment as the main effects. The effect of thiamethoxam was also evaluated on the Minute Pirate Bug, a generalist predator. One timing, 2 weeks after emergence, was evaluated. Two bugs were placed on to each seedling with and without spider mites as prey. Minute Pirate Bug mortality was assessed after 7 days of exposure. A factorial analysis was used with pest status and treatment as the main effects. Means were separated with Fisher's LSD at $P \leq 0.05$.

Results

Objective 1:

Early Planting (4/24/02): By planting early on April 24 populations of mites and leafminers were avoided and no treatments were needed (Table 1). Mites were not present until later in the season, after beans had set pods and begun to senesce. Leafminers were present but not in numbers high enough to warrant treating. Aphids were controlled in the IPM treatments with the systemic activity of thiamethoxam, the insecticide seed treatment (Figure 1). The seed treatment also provided 72% reduction of leafminer mines present on leaves in the Blackeyes compared to the untreated seed early in the season (Figure 2). The conventional treatment was planted using untreated seed and the Blackeyes and Baby Limas had to be treated for bean aphid on May 24 using dimethoate at 1 pt/A. Dimethoate provided 100% control of bean aphid populations (Figure1). The bean aphid was present in very low numbers on the Kidneys in the conventional treatment therefore they were not treated. On July 10 lygus populations reached the threshold level of 0.5 lygus per sweep in the Blackeyes and Baby Limas. IPM treatments were treated with indoxacarb at 6 oz./A. Conventional treatments were treated with acephate at 1 lb./A. Significant differences were seen between indoxacarb and acephate with acephate providing significantly better control 12 days after treatment (Figure 3). Later in the season the IPM Blackeyes and Baby Limas contained more vigorous and green foliage than the conventional treatments. A leaf sample determined that plots treated with organophosphate insecticides contained a higher population of mites (Figure 4).

Standard Planting (6/27/02): By planting on June 27, aphid populations were avoided and no plots were treated for aphid (Table 1). The standard planting date experienced larger populations of leafminers later in the season and mites early in the season compared to the early planting. On August 14 both systems required treatment for mites and lygus. Mite control in the IPM system was with bifenazate at 1 pt./A. Lygus control in the IPM system was with indoxacarb at 6 oz./A. The conventional system was treated with propargite at 2 pt./A for mites and acephate at 1 lb./A for lygus. Bifenazate provided significantly better mite control 21 days after treatment (9/4) compared to propargite (Figure 5). Acephate provided significantly better control of lygus 10 days after treatment (8/24) compared to indoxacarb (Figure 7). Leafminers were present but not in numbers high enough to warrant treating until after the August 14 treatment of propargite and acephate. These treatments seemed to flare leafminer populations to treatable levels in the conventional system. On August 22 both systems were treated for leafminer. Spinosad was applied at 6 oz./A to both the IPM and conventional treatments, due to the fact that it has become the standard product used for leafminer control and is currently registered as a reduced-risk material in dry beans. Both the IPM and conventional systems were treated to avoid allowing a reservoir in the IPM blocks. There were significant differences in number of mines per leaf 12 days after treatment with the IPM system containing fewer mines per leaf compared to the conventional system (Figure 6).

Objective 2: The early planting of Kidneys was harvested on August 7 and the Blackeyes and Baby Limas were harvested on August 28. The standard planting of Kidneys was harvested on September 26 and the Blackeyes and Baby Limas on October 17.

Yield: No yield differences were seen between treatments among all three varieties of beans (Figure 9). Significant differences were seen between planting dates. The standard planting date had higher yields for both California Early Light Red Kidney and Blackeye 46 compared to the early planting (Figure 10). There were no significant differences in yield between planting dates for Luna Baby Lima (Figure 10).

Quality Ratings: Lygus damage was evaluated for Blackeye and Baby Lima only. Kidneys were not evaluated because lygus were not a significant problem in Kidneys.

Between treatments the conventional system provided the lowest damage levels compared to the IPM system for Blackeye and Baby Lima. The conventional Blackeyes were placed into the U.S. 2 grading category. The IPM Blackeyes were placed into the substandard category. The conventional Baby Limas were placed into the U.S. 2 grading category (Table 2).

Between planting dates the early planting provided the lowest damage compared to the standard planting for Blackeye and Baby Lima (Table 3). The early planting of Blackeyes was placed into the U.S 1 grading category. The standard planting of Blackeyes were placed into the substandard category. The early planting of Baby Limas were placed into the U.S 2 grading category, whereas the standard planting was placed in the substandard category (Table 3).

Estimation of Economic Returns (Tables 5 & 6): Cost comparisons were made for each bean variety and for planting dates. For the early planting of Kidneys no treatments were applied for Bean aphid, leafminer, or mites. The standard planting of Kidneys had to be treated for mites and lygus, but not aphid. In the early planting a preirrigation was avoided due to existing rain fed moisture. For the standard planting a preirrigation was needed. For the early planting of Blackeyes and Baby Limas, aphids had to be treated in the conventional treatments but leafminer and mite pressures were avoided. In the late planting aphid populations were lower but leafminers and mites had to be treated in all three varieties. The early planting of Kidneys provided a savings of $25/Acre compared to the standard planting. The early planting of Blackeyes and Baby Limas provided a savings of $35/Acre compared to the standard planting. Yields were then compared between planting dates to determine if the savings in insect applications for the early planting would cover the cost of having slightly lower yields in the Kidneys and Blackeyes. It should be noted that the Kidney yields in this trial were much below the average for this area in both planting dates. Baby Limas were the only variety that had higher yields in the early planting. The higher yields combined with less chemical applications make early planting an option for Baby Limas. In this experiment Kidneys and Blackeyes had higher yields in the standard planting, but Blackeyes experienced significantly less lygus damage when using the conventional treatment along with early planting.

Objective 3: In Tulare County the main pest present was lygus bug. All other pest pressures were either absent or in numbers low enough to avoid treating. A single application was made on September 3, 2002 for lygus control. Indoxacarb was applied to the IPM treatment at 11.3 oz./A. Methomyl was applied to the conventional treatment at 1 lb/A.

No differences were seen between treatments for Lygus control (Figure 8).
No differences in yield were seen between treatments (Figure 11).
No differences in damage were seen between treatments. Both the conventional and IPM treatments were placed into the U.S. 1 grading category (Table 4).

Objective 4:

Aphid Study (Figure 12) – At 14 and 21 days after emergence, all treatments provided significantly better control compared to the untreated. At 28 days after emergence the high and middle rates of thiamethoxam provided better control than the untreated. At 35 days after emergence the high and low rates of thiamethoxam provided significantly better control compared to the untreated.

Thrips Study (Figure 13) –At 14 days after emergence all 3 rates of thiamethoxam provided significantly better control compared to the untreated. At 21 days after emergence no differences were seen among treatments. At 28 days after emergence the high rate of thiamethoxam provided significantly better control compared to the low rate of thiamethoxam. At 35 days after emergence treatments had begun to break down with the high rate maintaining significantly better control compared to the untreated.

Mite study (Figure 14) -No differences were seen among treatments for 14, 21, and 35 days after emergence. At 28 days after emergence the middle rate of thiamethoxam had higher populations of mites than the high rate and the untreated.

Minute Pirate Bug study (Table 7) –No conclusions can be made for this experiment. Minute pirate bug mortality was seen in all treatments, including the untreated control, whether spider mites were present as prey items or not.

Discussion

By planting early (April 24) damaging populations of mites and leafminers can be avoided, allowing the need for less chemical applications. Aphid populations can be problematic early in the season but utilizing thiamethoxam seed treatment provided 100% control of aphid without foliar chemical applications. Treating the seed with thiamethoxam eliminated the dimethoate application. By avoiding early chemical applications of organophosphates for aphid secondary pest populations, such as leafminers were reduced. Lygus were present early in the season causing less damage in the early planting compared to the standard planting for both Blackeye and Baby Lima. The reduced-risk product used for lygus control (indoxacarb) provided suppression of lygus whereas the conventional product (acephate) provided 100% control 12 days after treatment. The existing threshold levels may need to be reevaluated when treating with less efficacious products. Pest species may need to be targeted for treatment at different growth stages. It may be more beneficial to sample lygus nymphs as well as lygus adults when determining application timings. Differences in plant vigor were seen towards the end of the early-planted trial for Blackeye and Baby Lima. Plants in the IPM treatment were more vigorous and remained green compared to the conventional treatment. Samples taken from these blocks showed that mites were present in significantly higher numbers in the conventional compared to the IPM. Plots treated with acephate caused mite flare ups compared to plots treated with non-organophosphate insecticides (indoxacarb). Treating with acephate provided better control of lygus but at the expense of causing mite flare-ups. Late populations of mites were not treated since they occurred after beans had set pods and begun to dry down.

The standard planting (6/27) had lower aphid populations but leafminers and mites occurred in treatable levels. Lygus control was similar to the early planting, with indoxacarb providing suppression and acephate providing almost 100% control 14 days after treatment. Leafminers had not been present in treatable populations until after the application of acephate. The application of acephate seemed to flare leafminer populations to treatable levels in the conventional system and plots were treated with spinosad for leafminers. Significant differences were seen 12 days after treatment between the IPM and conventional with the IPM containing fewer mines per leaf compared to the conventional. The IPM plots maintained lower levels of leafminer damage throughout the duration of the study. The reduced-risk material, spinosad, was used for leafminer control in both the conventional and IPM treatments since it has become the industry standard. Mites were treated with bifenazate in the IPM treatment and propargite in the conventional treatment. Bifenazate provided significantly better control from 9/4 (21 days after treatment) to the end of the sampling period (9/25).

No significant differences in yield were seen between treatments among all three varieties of beans. Significant differences were seen between planting dates for Kidney and Blackeye with the standard planting showing higher yields. Baby Lima yields were unaffected by planting date. For the Tulare study no differences were in yield between treatments (Figure 11).

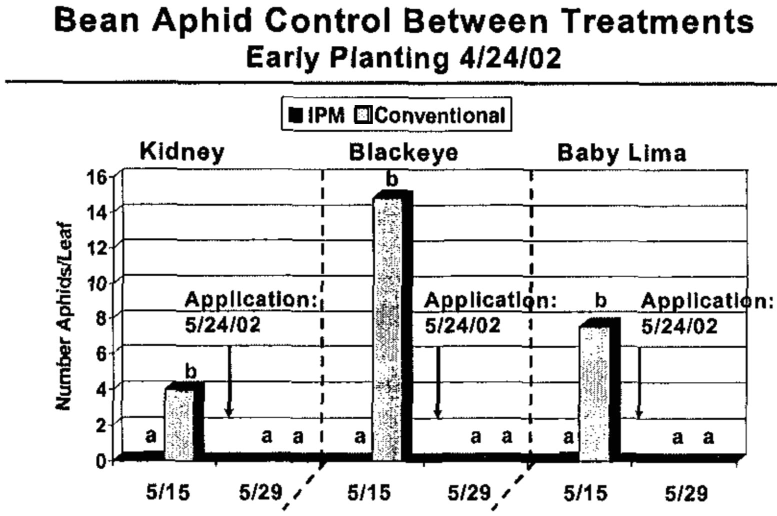
Quality ratings (lygus stings) between treatments showed that the conventional treatments had significantly less damage for Blackeye and Baby Lima compared to the IPM treatment (Table 2). Quality ratings between planting dates showed the early planting having significantly less damage compared to the standard planting (Table 3). No differences in quality were seen between treatments for the Tulare County location (Table 4).

Summary

Baby Limas responded well to early planting with no decrease in yields compared to the standard planting. Kidneys and Blackeyes produce better yields in the standard planting. The reduced-risk materials thiamethoxam, bifenazate, and spinosad provided adequate control of aphids, mites, and leafminers. More research to determine different treatment timings on insect growth stages is needed to decide if indoxacarb will be a useful tool in an integrated system. Lygus populations may have to be treated as soon as nymphs are seen. The only problem being that nymphs are not sampled well with the sweep net. Based on this research, new, reduced-risk pesticides can be useful in implementing a partial IPM system for dry beans. Lygus control with acephate will have to remain in the system until more efficacious products are developed or research that establishes new threshold guidelines for less effective products is completed. If a proper reduced-risk chemical can be found for lygus bean growers will have an adequate reduced-risk production system in place and will no longer have to rely on organophosphates and carbamates. Local growers and pest control advisors showed great interest in this research study. As soon as the reduced-risk products analyzed in this study are registered growers will most likely implement these new products and ideas into their pest management program.

Appendices

Figure 1



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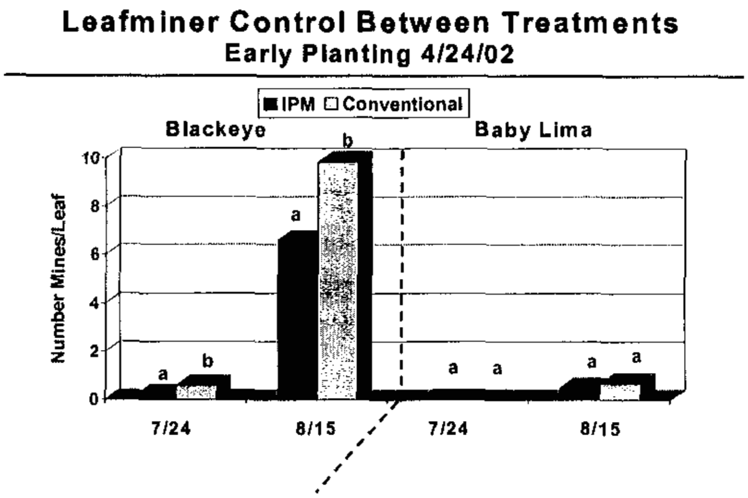

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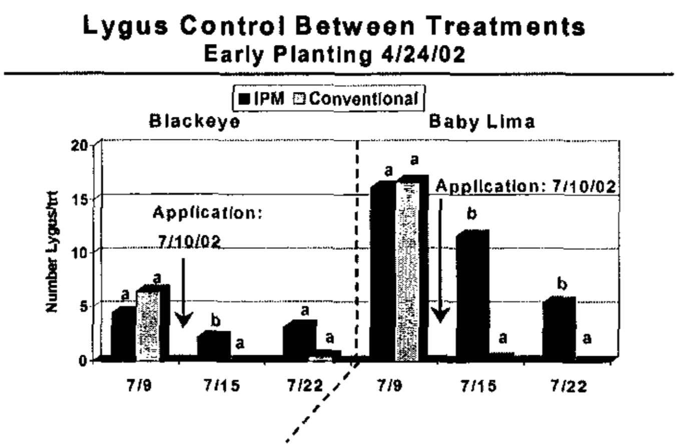

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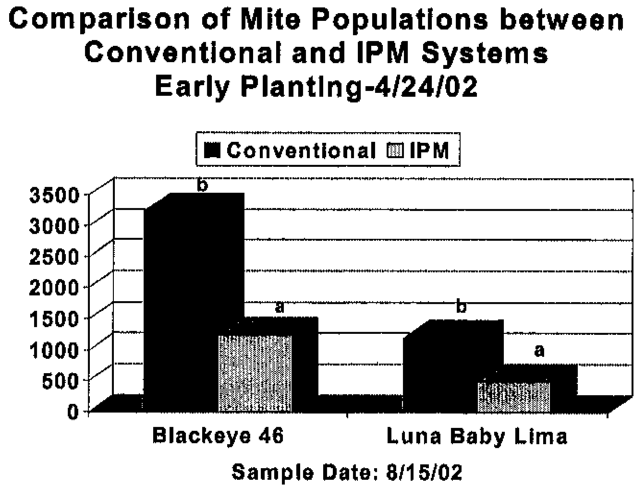

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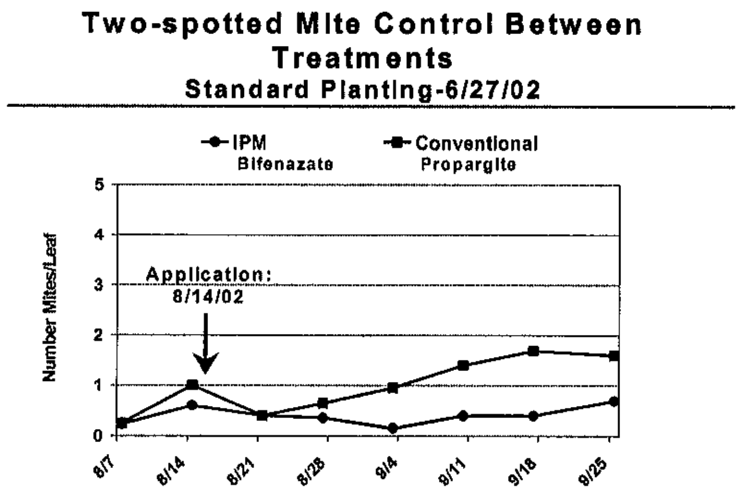
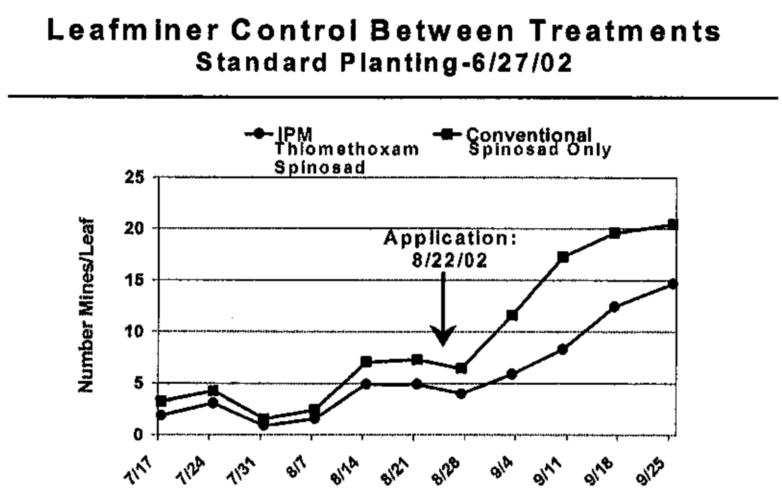


Figure 6



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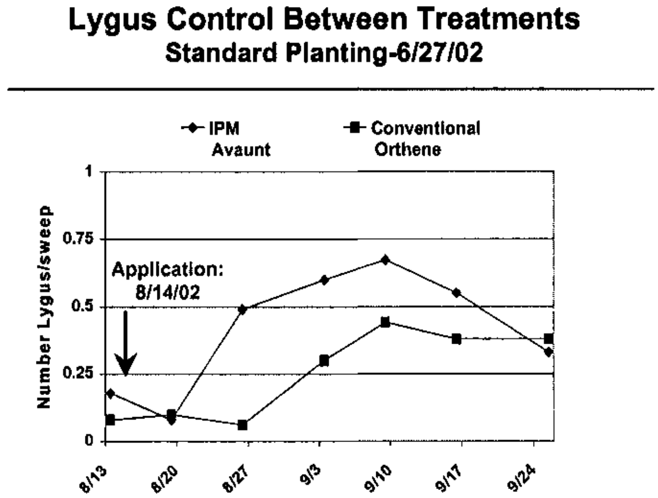

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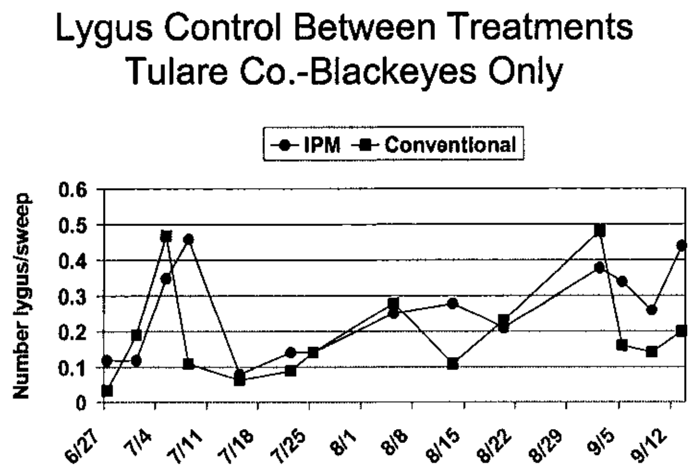
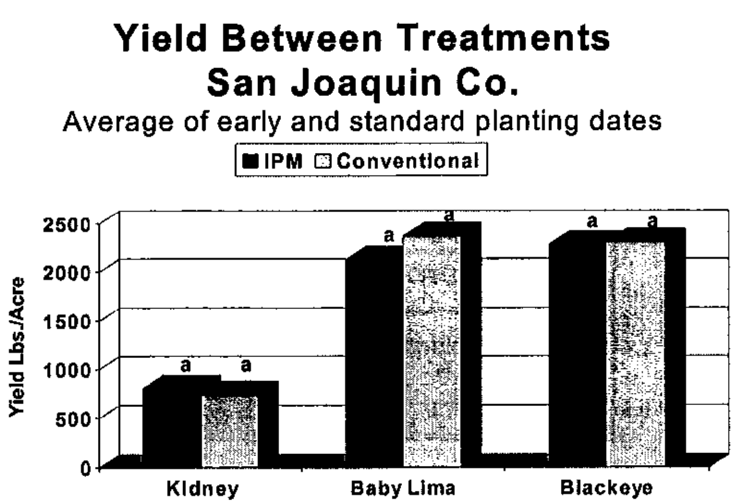


Figure 9



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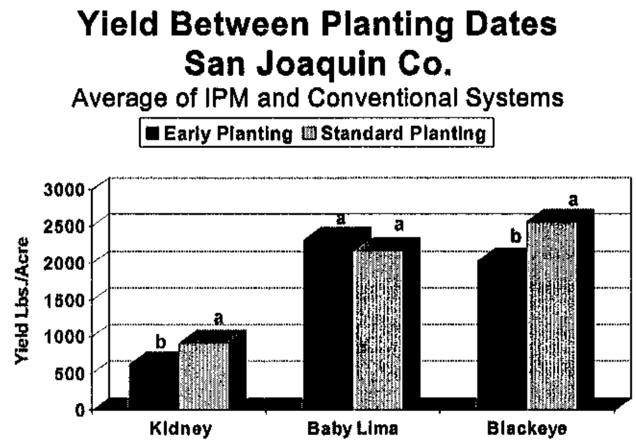

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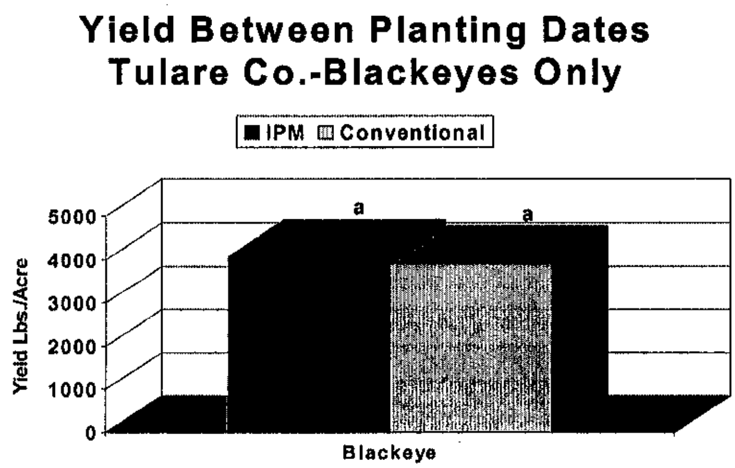

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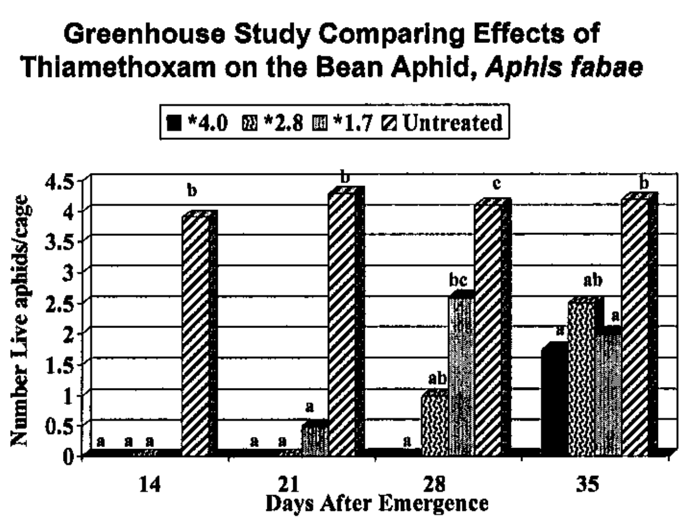
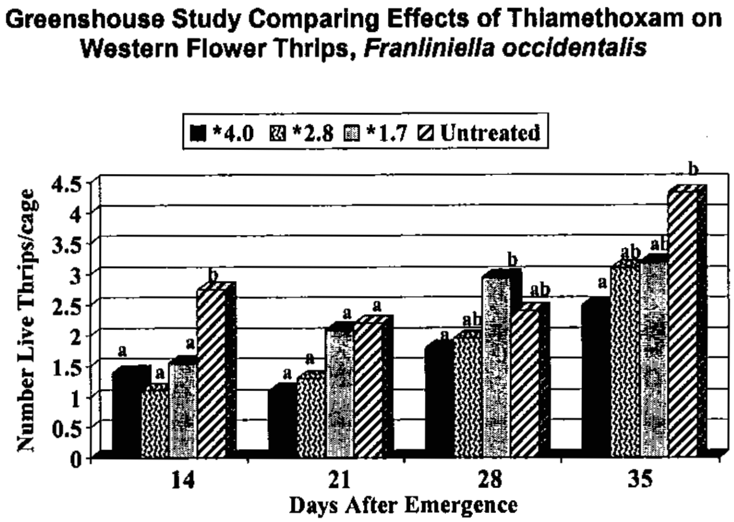


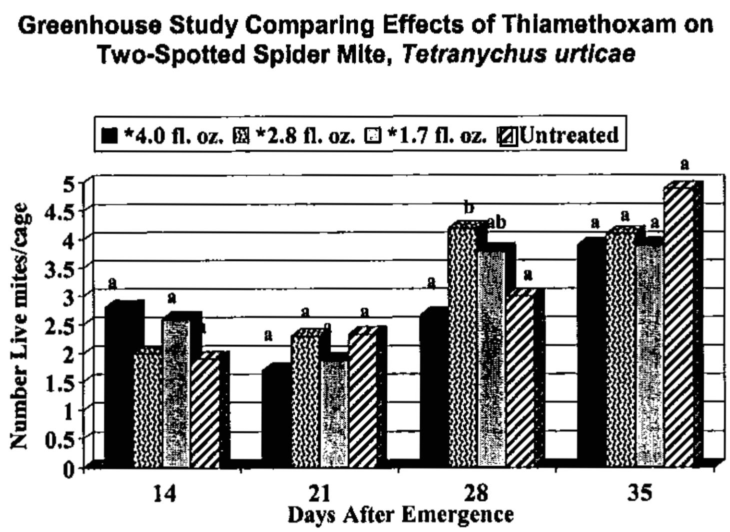
*Rate fl. oz./ 100 lbs. of seed

Figure 13



*Rate fl. oz./100 lbs. of seed

Figure 14



*Rate fl. oz./100 lbs. of seed

Table 1

Comparison of Arthropod Populations Between Planting Dates

Pests of Dry Beans	Early	Standard
Aphis fabae	X	O
Liriomyza spp.	O	X
Tetranychus spp.	O	X
Lygus hesperus	X	X
Lepidoptera	NP	O
Bemisia spp.	NP	NP

O=Present, not treated
X=Treated, NP=Not Present

Table 2

Quality Ratings-%Damage *Damage Between Treatments

	Blackeye 46				Luna Baby Lima			
	**Damage Categories				**Damage Categories			
Treatment	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
Conventional	94.1	2.3	0.73	2.9	96.5	1.5	0.6	1.4
IPM	84.7	5.0	2.7	7.6	94.0	2.3	1.5	2.2

*Average of 500-beans/ plot visually inspected and placed into corresponding damage category.

**Rating Scale
0=No damage
1=light damage
2=medium damage
3=high damage, beans deformed

Table 3

Quality Ratings-% Damage *Damage Between Planting Dates								
	Blackeye 46				**Luna Baby Lima**			
	****Damage Categories**				****Damage Categories**			
Treatment	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
Early Planting	95.8	1.1	0.83	2.3	96.8	1.7	0.93	0.63
Standard Planting	83.1	6.1	2.6	8.2	93.2	2.3	1.3	3.2

*Average of 500-beans/ plot visually inspected and placed into corresponding damage category.

**Rating scale
0=No damage
1=light damage
2=medium damage
3=high damage, beans deformed

Table 4

Quality Ratings-% Damage Tulare County *Damage Between Treatments				
	Blackeye 46 **Damage Categories			
Treatment	0	1	2	3
Conventional	98.2	0.3	0.5	1.0
IPM	98.4	0.6	0.2	0.8

*Average of 500-beans/ plot visually inspected and placed into corresponding damage category.

**Rating scale
0=No damage
1=light damage
2=medium damage
3=high damage, beans deformed

Table 5

*Cost Comparison-$/Acre

Mgt.Practices	Early		Standard	
Stubble disc	10		10	
List Beds	13		13	
Starter Fertilizer	26		26	
PP Herbicide	30		30	
Preirrigation	0		20	
Irrigation	30		30	
	Kidney		**Blackeye & B. Lima**	
Insect App.	Early	Standard	Early	Standard
Aphid	0	0	20	20
Lygus	15	15	15	15
Leafminer	0	0	0	30
Mites	0	25	0	25
	124	149	144	199
Total Savings =	**25**		**55**	

*Dollar estimates based on UC Davis Dry Bean Cost Studies

Table 6

Profit per Acre

	Early		Standard	
	* cwt/Ac	$/Ac	cwt/Ac	$/Ac
Kidneys	6	180 **+25=205**	9	270
Blackeyes	20	600 **+55=655**	26	780
Baby Limas	23	690 **+55=745**	22	660

*Estimated at $30/cwt.

Table 7

Greenhouse Study Comparing Effects of Thiamethoxam on the Minute Pirate Bug, *Orius tristicolor*,		
	spider mites present Number live *Orius* present	Spider mites absent Number live *Orius* present
1.7 fl. oz./100 lbs. of seed	0.0 a	0.0 a
2.8 fl. oz./100 lbs. of seed	0.0 a	0.0 a
4.0 fl. oz./100 lbs. of seed	0.0 a	0.0 a
Untreated	0.0 a	0.0 a
LSD=	NSD	NSD

1) Proposal Title

Development of an Integrated Pest Management System for Dry Bean Production in the San Joaquin Valley

Project Summary Form

2) Principal Investigator

Mick Canevari

3) Alternative Practices

Compare the effectiveness ofnew, reduced-risk insecticides to currently registered, conventional materials (organophosphates, carbamates). Determine whether insecticide applications can be reduced or eliminated by planting earlier in the season to avoid mites, leafminers, and lygus.

4) Summary of Project Successes

By planting early (4/24/02), damaging populations of leafminers can be avoided, minimizing insecticde applications. Thiamethoxam provided 100% control of the bean aphid and provided suppression of leafminer. Planting early allowed for the avoidance of two insecticide applications, one for leafminer and one for mites.

5) Number of Participating Growers	2	12) Number of Field Days	1
6) Total Acreage in Project	2	13) Attendance at Field Days	50
7) Project Acreage Under Reduced Risk	1	14) Number of Workshops & Meetings	2
8) Total Acres of Project Crop	0	15) Workshop Attendance	30
9) Non-Project Reduced Risk Acres	0	16) Number of Newsletters	0
10) Number of Participating PCAs	0	17) Number of Articles	0
		18) Number of Presentations	6

11) Cost Assessment

The early planting of kidneys provided a savings of $25/acre. The early planting of blackeyes and baby limas provided a savings of $35/acre. Lower yields of kidneys and blackeyes in the early planting offset the savings gained by planting early. Baby limas had higher yields in the early planting. The higher yields combined with less chemical applications make early planting a feasible option for baby limas.

19) Other Outreach Activities

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Contract Number ____ Project ID ____

DPR ID# ____ Contract Manager ____ 25th May 2001